MOUNT BAKER-SNOQUALMIE NATIONAL FOREST
SPECIALIST REPORT OUTLINE
ENVIRONMENTAL ASSESSMENT

South Fork Stillaguamish Vegetation Management Project

Fire, Fuels, and Air Quality

Britt Davis, Zone Fire Management Officer

Draft of11/1/2016

1. Applicable Laws, Regulations, and Policies

Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan (Forest Plan, and amendments), 1990.

State of Washington Smoke Management Plan, 1993 (Revised 1998).

Federal Clean Air Act, 1990.

Forest Service Manual: Chapter 5150 Fuel Management.

NWCG Interagency Prescribed Fire Planning and Implementation Guide, 2008.

2. Relevant Standards and Guidelines

p. 4-143 Fire Management Direction, Group A, Management Area 11: Late successional reserve:

Prescribed Fire Direction: Prescribed fire may be utilized to accomplish specific resource management objectives if it is the most cost effective method. All projects will recognize air quality and smoke management constraints. Unplanned ignitions may be used if they occur when prescription parameters needed to accomplish the prescribed fire objectives for the area can be met.

Fuel Management Objectives: Activity fuels will be treated to the level necessary to achieve the expected resource objectives of the area. Normally this will be to return the area to as near natural appearance as possible. Natural fuels will not be treated except where necessary to meet specific resource or activity objectives.

p. 4-145 Fire Management Direction, Group C, Management Area 1B Dispersed Recreation: Semi-Primitive Nonmotorized:

Prescribed Fire Direction: Prescribed fire may be utilized to accomplish specific resource management objectives if it is the most cost effective method. All projects will recognize air

quality and smoke management constraints. Unplanned ignitions may be used if they occur when prescription parameters needed to accomplish the prescribed fire objectives for the area can be met.

Fuel Management Objectives: Activity fuels will be treated to the level necessary to achieve the expected resource objectives of the area. Normally this will be to return the area to as near natural appearance as possible. Natural fuels will not be treated except where necessary to meet a specific resource or activity objective.

p. 4-147 Fire Management Direction, Group D, Management Areas5B: Recommended Scenic River and 5C: Recommended Wild River:

Prescribed Fire Direction: Prescribed fire has limited application in this allocation. Maintenance of total vegetation cover is critical to meeting resource objectives. Some burning of piled debris may be utilized.

Fuel Management Objectives: Natural fuels shall be left in place for soil stability. Activity fuels shall be treated to (1) a level that results in a fire intensity of no more than Class 3 (Flame Length 4 to 6 Ft) when measured 3 years from creation under median summertime weather conditions or (2) meet specific resource need, whichever is lower.

p. 4-147 Fire Management Direction, Group E(1), Management Areas15: Mountain Goat Habitat and 19: Mountain Hemlock Zone:

Prescribed Fire Direction: Prescribed fire may be utilized to accomplish specific resource management objectives. Plans must be accompanied by an evaluation which indicates it to be the most environmentally and cost effective method to meet the objectives. Only planned ignitions will be utilized. All projects will be executed in accordance with air quality and smoke management guidelines.

Fuel Management Objectives: Natural fuels will be treated only when necessary to meet a specific resource or activity objective. Treatment of activity fuels to meet specific resource or activity objectives will in most cases achieve residue loadings compatible with protection needs of this area. Except where environmental constraints prohibit it, the projected fire intensity caused by the presence of activity fuels should not exceed FIL 3 when evaluated at a point in time three years after creation under median weather conditions for the area.

1994 Forest Plan, as Amended, Record of Decision p. C-17

C-17 Late Successional Reserve; Standards and Guidelines; Fire Suppression and Prevention: In Riparian and Late-Successional Reserves, the goal of wildfire suppression is to limit the size of all fires…Rapidly extinguishing smoldering coarse woody debris and duff should be considered to preserve these ecosystem elements.

Implementation Strategy for the Federal Wildland Fire Policy (2009) p. 10

Policy Clarification of Management Intent and Implementation Actions; Policy Statement 2: Fire Management and Ecosystem Sustainability - The full range of fire management activities will be used to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social components. Agencies will exploit the full range of fire management options to sustain healthy ecosystems within acceptable risk levels as identified in the L/RMP, or Fire Management Plan (FMP). Fire management activities will be based on planning and decision analysis processes that address current and anticipated situational conditions.

Air Quality:

1990 Forest Plan p. 4-114 and 4-118

All management activities that generate smoke will be executed in strict conformance with the Washington State Implementation Plan, which restricts the quantity and timing of activities to minimize impacts on health and quality of life (1990 Forest Plan, p. 4-41).

Maintain aerosol concentrations and particulate levels over the wilderness areas at levels that do not adversely affect identified Air Quality Related Values for each area (1990 Forest Plan, p. 4-114).

The Forest Service will comply with all applicable air quality laws and regulations, and coordinate with appropriate air quality regulatory agencies (1990 Forest Plan, p. 4-118).

3. Other Programmatic Direction

Forest Service Manual: Chapter 5150 Fuel Management.

5150.2 - Objective. To identify, develop, and maintain fuel profiles that contribute to the most cost-efficient fire protection and use program in support of land and resource management direction in the forest plan

5150.3 - Policy. Integrate fuel management and fire management programs in support of resource management objectives.

1. Use an interdisciplinary approach to integrate fuel management planning into all appropriate activities.
    a. Identify, through an economic analysis, the most cost-efficient fuel profile to meet resource management direction in support of the fire protection program. Consider a full range of fuel management alternatives, including no treatment. Fuel management activities must be responsive to long-term site productivity, utilization opportunities, and air quality considerations.
    b. Where a management activity, such as timber sales, thinning, or road construction, contributes to an unacceptable fuel profile, modify that activity to reduce its incremental contribution to the fuel profile.

5151.1 - Methods of Fuel Treatment. Consider the following treatment options, in the priority listed, when developing fuel management direction and plans.

1. Utilization. Use methods that reduce unwanted fuel through improved harvest techniques or through higher utilization standards. Favor utilization when the cost of onsite treatment equals the cost of removal for utilization.

2. Rearrangement. Redistribute fuel onsite to a condition that is less hazardous, or that enables more rapid deterioration or more effective disposal.

3. Removal. Remove unwanted fuel offsite for further utilization, storage, or disposal.

4. Disposal. Reduce or eliminate unwanted fuel onsite. Methods include manual, mechanical, chemical, biological, and prescribed fire treatments and their necessary associated activities.

5. Conversion. Replace hazardous fuel with less flammable fuel or fuel that offers less resistance to suppression.

6. Nontreatment. Where appropriate, identify if and when fire program costs plus anticipated net value changes do not justify fuel treatment.

4. Definitions of Technical Terms

Activity Fuels: Fuels resulting from, or altered by, forestry practices such as timber harvesting and thinning, as opposed to naturally created fuels.

Fire Hazard: A fuel complex, defined by volume, type condition, arrangement and location, that that determines the degree of ease of ignition and resistance to control.

Fire Risk: The chance of fire starting, as determined by the presence and activity of causative agents.

Fire Intensity Level 3 (FIL 3): Fire intensity levels (FILs) provide "an expression of fireline intensity, based on typical and/ or calculated flame length of a fire behavior condition. FILs are used in the analysis to reflect the differences in difficulty of suppression and fire effects on natural and cultural resources." (Ref. FSH5109.19 ch40.5 9/85) A Fire Intensity Level 3 results in flame lengths ranging from four to six feet.

Flame Length: The distance between the flame tip and the midpoint of the flame depth (generally the ground surface), an indicator of fire intensity.

Fuel Models: The Fire Behavior Prediction System utilizes 13 fuel models to represent fuel conditions. This project has areas represented by four fuel models:

Fuel Model	Description
10	Timber
11	Light Logging Slash
12	Medium Logging Slash
13	Heavy Logging Slash

ML2 through 5 Roads: Forest Service system roads with a designated Maintenance Level that permits use by the public. All other roads in the project are temporary, will be decommissioned, or have a Maintenance Level 1, meaning they would be closed to motorized use by the public upon completion of the project.

5. Management Requirements and Mitigation Measures

The project requires no Management Requirements or Mitigation measures for Fire, Fuels, and Air Quality.

6. Analysis Methodology, Assumptions

Median Weather Data was generated from 10 years of weather data collected at the Gold Hill Remote Automated Weather Station (RAWS) between the Sauk and Suiattle River drainages of the Darrington Ranger District. Gold Hill RAWS is the wettest of the RAWS locations within the North Zone, yet is still likely dryer than the project area, resulting in conservative potential fire behavior modeling. The weather data was analyzed in Fire Family Plus, developing a moderate weather parameter from 41st to 60th percentile weather observations from July 15-September 1 in the years starting in 2006 and ending in 2016. See Figure 1.

FireFamily Plus Percentile Weather Report for RERAP

Station: 451613: GOLD MT Variable: SC
Model: 7G3PE3
Data Years: 2006 - 2016
Date Range: July 15 - September 1
Wind Directions: N, NE, E, SE, S, SW, W, NW

Percentiles, Probabilities, and Mid-Points

Variable/Component Range	Low	Mod	High	Ext
Percentile Range	0 - 40	41 - 60	61 - 97	98 - 100
Climatol. Probability	40	20	37	3
Mid-Point SC	1 - 1	3 - 3	4 - 4	6 - 6
Num Observations	17	137	148	29
Calculated Spread Comp.	1	3	4	6
Calculated ERC	12	19	28	40
Fuel Moistures				
1 Hour Fuel Moisture	22.34	10.94	8.67	6.24
10 Hour Fuel Moisture	21.75	12.18	9.89	7.32
100 Hour Fuel Moisture	19.38	17.13	14.77	11.63
Herbaceous Fuel Moisture	141.67	155.30	110.99	79.63
Woody Fuel Moisture	158.61	164.84	143.99	119.06
20' Wind Speed	1.65	1.96	2.34	3.17
1000 Hour Fuel Moisture	20.77	21.22	18.72	15.91

505 Weather Records Used, 505 Days With Wind (100.00%)

Figure 1: Median Weather Conditions

Commercial Thinning Treatments

Forest Vegetation Simulator (FVS) and the Fire and Fuels Extention (FFE) were used to estimate fuel loadings by class size and potential fire behavior that would result from the proposed commercial thinning treatments on each set of stand exam data. The same model assumptions were made in the fire and fuels FVS model runs as were made in the silvicultural FVS model runs.FVS and the FFE extension use stand exam data and the results of treatments applied within the model to assign a fuel model or combination of fuel models that best represent the projected fuel and fire behavior for a given stand in a given year. The Gold Hill RAWS median weather data above was input to generate fuels and fire behavior projections three years post treatment.

Within the model, proposed commercial thinning treatments were applied to the stands in 2017. The projected fuels and potential fire outputs for 2020were used to measure whether the project is expected to comply with forest plan objectives.Complete results of these model runs are included as FVS .out files by reference, and the summary of these results is included below. See Table 1.

Stand Number	Flame Length	Fire Intensity Level	Stand Number	Flame Length	Fire Intensity Level
1	3.3	2	36	3.1	2
2	3.4	2	42	3.8	2
3	2.2	2	43	5.3	3
8	2.8	2	49	5.3	3
9	3.7	2	51	6.3	4
11	2.5	2	54	5.4	3
14	4.6	3	55	3.9	2
16	3.1	2	56	2.7	2
18	3.1	2	57	2.2	2
19	3.9	2	58	3.5	2
20	4.1	3	59	3.1	2
24	4.5	3	60	3.5	2
25	4.3	3	61	5.8	3
26	3.7	2	62	4.4	3
27	5.2	3	64	4.4	3
28	3.3	2	67	3.5	2

Table 1: Summary of post treatment Fire Intensity Level

Fire behavior adjacent to ML2 through 5 roads was determined using fire behavior projections generated in BehavePlus 5.0.5. The fuel loading in areas where activity fuels have been treated (slopes in excess of 20%)was estimated using standard photo series and data comparisons (Anderson, 1982, Scott and Burgan, 2005, Maxwell and Ward, 1976). There would be expected variability between surface fuel conditions in these treated locations, and a general Fuel Model 8 was found to be the most representative fuel model. Slope in the units varies considerably but averages about 30% and ranges just above 60%. Using fuel model 8, varying slopes (narrowing it down to 19%, 20%, & 21% as displayed), and typical fire weather data from Gold Hill RAWS (80^{th} percentile), pre and post-fuels treatment anticipated fire behavior was calculated using BehavePlus 5.0.5. The output (see Figure2) indicates that for a new start at a road, and a typical suppression response, treatment of slash on slopes greater than 20% was required for a successful initial attack.

Contain Status

Fuel Model	Slope Steepness %		
	19	20	21
8	Contained	Contained	Contained
12	Contained	Withdrawn	Withdrawn

Figure 2: Treatment necessary for successful IA.

Precommercial Thinning Treatments

In December of 2014 a study of the effects of precommercial thinning on the forest as it relates to anticipated fire behavior and Forest Plan compliance was completed. The study report is included by reference.

The results of that study indicated that under median weather conditions, even in the year of treatment the predicted FIL would be a 2 and by three years post treatment, predicted FIL dropped to a 1. While that study took place in the Baker Lake Basin, it occurred in similar fuels to those found in the South Fork Stillaguamish Project area. In addition, the South Fork Stillaguamish Project area is a wetter site, with reduced 50th percentile weather conditions, indicating that if anything, expected post precommercial thinning treatment fire behavior would be reduced below that predicted in the study area.

System Road Modifications

Historical Fire Occurrence

Individual fire records, from 1952 to present, provide insight into expected future fire trends on the MBS.Human-caused ignitions constitute the majority of annual fire starts on the Forest. Within the South Fork Stillaguamish Project area, 66 of the area's 83 fires (80%) have occurred on or within ¼ of a mile of a road or trail. This trend will likely continue for the foreseeable future, as sub-geographic populations and subsequent forest use increases. This is particularly true in areas which contain concentrated urban interface and road-accessed recreational opportunities.

Assumptions

The Forest road system provides both benefits and costs to the fire management program as it relates to ignitions, access, and control.

Open Roads - Roads that are open to the public provide increased access to initial attack resources, and can act as fire control lines. This benefit is offset by the increased public access and the human caused ignitions that come with it.

Closed Roads – Roads that are closed also provide varying degrees of access to initial attack resources, ranging from full vehicular access down to rough trail like conditions that allow resources to hike closer to a fire. These roads can also be easily improved by mechanized equipment to perform as fire control lines. Because the roads are closed to the public, the risk of human ignitions is not increased significantly along these corridors.

Obliterated Roads – Roads that have been permanently closed, and removed from the road system can often still provide rough trail like conditions to allow initial attack resources to hike closer to a fire. With moderate improvements, these road beds can still be converted into fire control lines. Because the roads are no longer available to the public, the risk of human ignitions is not increased significantly along these corridors.

Analysis Methodology

Based on staff experience, it was determined that the benefits of road access to suppression resources is typically ¼ mile or less, as terrain and fuels prevent effective ground resource penetration beyond that distance. Response to any fires more than ¼ mile from a road or trail will typically be from aerially delivered firefighters.

It is assumed that any reduction in casual public access that does not limit suppression resource access provides a net benefit from the standpoint of fire management. This would have the effect of reducing the number of human caused fires, without materially hampering initial attack activity. Examples of this include closing or obliterating currently open roads. In doing so, fires related to human activity are reduced, while some benefit from an initial attack or extended attack standpoint remain.

It is assumed that any road modifications that result in increased casual public access such as road openings will result in a net negative effect from a fire management perspective. This would have the effect of increasing the number of human caused fires, without materially improving initial attack access. Examples of this are opening roads that are currently closed by gate, earthen berm, or brush, which can be easily removed for suppression activity. Another road modification that could result in a net negative would be cases where roads that are currently closed by gate, earthen berm, or brush, which are subsequently obliterated, would not result in material reduction of human caused fires, but would somewhat limit initial attack resource access. Note that the remaining obliterated road bed would still provide a suppression resource benefit as a graded piece of ground that could potentially be re-cleared as a control or containment line.

7. Affected Environment

Background and Stand Characteristics

Stands in the planning area are a variety of age-classes based on fire history and previous harvest date. A fire history map (attached in section 12) was created by David Keenum using layers created by Jan Henderson. It shows that landscape level fires last occurred in the project area between around 300 and 500 years ago. A stand origin map (also created by David Keenum and attached in section 12), shows that all of the areas of proposed thinning have had a disturbance event within the past 70 years and fall within areas harvested between 1940 and 1979. Stand exams were conducted in 2015 and a model representation of stand conditions is included by reference in the FVS .out files.

Descriptive fuel models

All stand exam plots reflected a pre-harvest surface fuel condition represented by Fuel Model 10. Fuel Models present, or projected, in this Project area are:

Fuel Model	Description
10	Timber
11	Light Logging Slash
12	Medium Logging Slash
13	Heavy Logging Slash

8. Environmental Effects (includes Cumulative)

The analysis area for direct and indirect effects to fuels, fire suppression,and air quality activities is the South Fork Stillaguamish Watershed.

Alternative 1 – No Action

The No Action Alternative would cause no change to current trends for surface fuel conditions. Natural accumulation of natural forest fuels would continue, partially offset by natural decomposition of forest-floor fuel.

In the absence of a disturbance such as a fire or windstorm, surface fuel loading would initially remain light in the 42-77year-old stands. Generally, surface fuels would be limited to compact needle cast and small diameter dead fuels consistent with the closed timber litter fuel model.This is consistent with the typical condition of 40 to 80-year-old stands in the northwest Cascades.

Risk of fire starts within the project area is generally low. Lightning and human starts have been a factor in fire occurrence in the surrounding Stillaguamish Watershed, and few of these starts have become large fires. Current use patterns, fuel conditions, and fire history represent a relatively low-risk for unplanned ignitions.

Over time, as stands grow to maturity in approximately 130 years, fuel loading would increase gradually, assuming no substantial change in the two fire behavior indicators. Predicted rate of spread and flame length during periods of elevated fire danger (defined as 90th percentile fuel conditions) would generally not exceed initial attack capability; most unplanned ignitions would be suppressed during initial attack. A gradual shift in fuel loading would result in heavier timber conditions as the stand reaches maturity and stand succession occurs, creating more surface fuels. The fire behavior indicators would gradually increase, resulting in increased resistance to control for initial attack.

Alternative 1 would result no significant change to current initial attack and extended attack suppression response. It is anticipated that roads would continue to be under-maintained, and accordingly a degradation of public and suppression access would continue, with a net neutral result.

Air quality would be continue to be affected by regional contributors such as urban pollutants, agricultural and forestry burning, and recreational campfires and vehicle driving. There would be no contribution to air quality from the South Fork Stillaguamish project.

Alternative 2

FVS model runs show that commercial thinning treatments would change surface fuel conditions from primarilyFuel Model 10 (Closed Timber Litter) to some combination of Fuel Model 10, Fuel Model 11 (Light Logging Slash), Fuel Model 12 (Medium Logging Slash), and/or Fuel Model 13 (Heavy Logging Slash) in the years immediately following harvest.This would result in approximately 3,900 acresconverted to surface fuel conditions that are more resistant to suppression of fires, and would slightly increase the chance of a large fire in the South Fork Stillaguamish Watershed. As the stands mature in the next 20-50 years and beyond, fuels on the ground would decay, and understory woulddevelop. A slow transition would occur from slash fuel conditions back to timber fuel conditions. On this longer timeframe, the effect of altered resistance to suppression and increased chance of a large fire would slowly decline.

The project may slightly increase the risk of human-caused fires. Opening of timber stands and creation of landings along open roadways may increase public use of the area for recreation, hunting, and firewood cutting. Treatment of activity fuels in areas along these open roads as described in the proposed action would increase but not guarantee the chance of success of initial attack suppression. Risk of human starts in the South Fork Stillaguamish Watershed would increase proportionately with increased human use.

The South Fork Stillaguamish Project would contribute to air quality impacts in terms of logging vehicle traffic and prescribed slash burning, both of which would be slightly above fluctuating background levels, and temporary and ending upon the completion of post-sale activities.All slash disposal burning would be conducted in accordance with all applicable policy, guidance, and direction. Effects of the proposed action to air quality are expected to be neutral.

Cumulative Effects

The affected area for cumulative effects to fuels and fire suppression is the South Fork Stillaguamish Watershed. Logging known to have occurred in the South Fork Stillaguamish Watershed within the past 75years includes approximately 12,700 acres, for which activity fuel treatments are unknown. Surface fuel loads resulting from these actions are presumed to have increased, but subsequent decay, fuel bed compaction, and understory development since that time have moderated those effects. No substantial areas of persisting logging slash fuel conditions exist. Unknown future activities occurring on either federal or private inholdings within the South Fork Stillaguamish Watershed such as pre-commercial thinning or commercial timber harvest would contribute to additional acres converted to slash fuel conditions and would cumulatively increase the chance of a large fire in the South Fork Stillaguamish Watershed. The degree of this contribution would be slight. The South Fork Stillaguamish project would also contribute slightly to the cumulative increase in chances of a large fire in the South Fork Stillaguamish Watershed.

Alternative 1 or Alternative 2 are not expected to disproportionately affect the ability of the fire management program to manage wildland fire within the project area in a cost effective manner. Therefore, they would not contribute to cumulative effects associated with the reduction of road access to Forest lands when added to other past, present and future projects, including those described in Appendix C.

The cumulatively affected area for air quality is the large Puget Sound regional airshed, which encompasses far northwest Washington State tributary to Puget Sound, and includes the South Fork Stillaguamish Watershed. The South Fork Stillaguamish Project's contribution to regional air quality impacts, from logging vehicle traffic and prescribed burning, would be so slight as to be negligible, and would end with post-sale activities.

9. Forest Plan Consistency

The most stringent Forest Plan objective for fuels management recommends that "projected fire intensity caused by the presence of activity fuels should not exceed FIL3 when evaluated at a point 3 years after creation under median weather conditions for the area" (p. 4-147). An analysis of all data points using FVS model runs show that at the project scale, the Proposed Action would meet this objective. Average projected FILfor each commercial treatment on the stands where those treatments would be applied would not exceed 3.

Projected FILdoes exceeda 3 onone of the 32individual model runs, by 5% (0.3 foot flame length).Not only is this a slight deviation, but the stand in question does not fall under that stringent FIL 3 constraint; for this stand "Activity fuels will be treated to the level necessary to achieve the expected resource objectives of the area. Normally this will be to return the area to as near natural appearance as possible" (p. 4-143). The proposed treatment of activity fuels is to scatter them back into the unit, in an effort to mask ground disturbed by harvest activities and is compliant with that standard.

While the action alternative would provide varying degrees of access and, therefore, varying levels of support for meeting Forest Plan goals and objectives for fire management Forest lands in the drainage, they are consistent with the Forest Plan standards and guidelines for fire management.

All Alternatives would be consistent with the standards and guidelines for prescribed fire and for fire and fuel management in the Forest Plan, as amended.

Project Record

This EA hereby incorporates by reference the Fire and Fuels Specialist report (40CFR 1502.21). The Fire and Fuels Specialist Report is located in the Project Record and contains the detailed data, Affected Environment, analysis, references and technical documentation that the Fire and Fuels Specialist relied upon to reach the conclusion in this EA.

10. Public Comment Response

There were no key public comments related to fire, fuels, or air quality.

11. References and Citations

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12. Maps (Indexed) if not within report

Fire history and stand age maps are also located in the project record at O:\NFS\MtBakerSnoqualmie\Project\SFStillaguamishVegMgmt2015\Specialists Reports\FireFuels\OtherProductsUsed

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